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CLAIMS

1. A process exhaust gas monitoring device that monitors the amount of each component of process exhaust gas containing a plurality of gas components resulted from a process carried out for a process object under predetermined process conditions,

said device comprising:  
gas sampling means for sampling the process exhaust gas;  
gas analysis means for analyzing each component of the sampled process exhaust gas;  
comparison means for comparing an analysis result from the gas analysis means with a reference analysis result of the process exhaust gas generated from a process carried out under reference process conditions; and  
detection means for generating and outputting a signal indicating a process error, when it is determined from the comparison result from the comparison means that the amount of at least one gas component of the process exhaust gas has changed to an amount that is outside a predetermined range set around a reference value obtained from the reference analysis result.

2. The process exhaust gas monitoring device as claimed in claim 1, wherein the gas analysis means is a Fourier-transform infrared spectroscope.

3. The process exhaust gas monitoring device as claimed in claim 1 or 2, further comprising alarm means for giving an alarm in accordance with the signal outputted from the detection means.

4. The process exhaust gas monitoring device as claimed in claim 1 or 2, further comprising control means for automatically adjusting the process conditions in accordance with the signal  
5 outputted from the detection means.

5. The process exhaust gas monitoring device as claimed in claim 1 or 2, further comprising memory means for storing the analysis  
10 result from the gas analysis means,  
wherein the comparison means compares a plurality of analysis results with the reference analysis result.

6. The process exhaust gas monitoring device as claimed in claim 1 or 2, further comprising memory means for storing a plurality of reference analysis results,  
15 wherein the comparison means compares each  
20 of a plurality of analysis results with each corresponding one of the plurality of reference analysis results.

7. The process exhaust gas monitoring device as claimed in claim 1 or 2, further  
25 comprising switch means for switching process exhaust gas passages for sampling the process exhaust gas at a plurality of locations.

8. The process exhaust gas monitoring device as claimed in claim 7, further comprising control means for controlling operations of the gas analysis means and the switch means.  
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9. The process exhaust gas monitoring device as claimed in claim 8, further comprising comparison result memory means for storing a  
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comparison data resulted from the comparison means,  
wherein the comparison means performs a  
comparison operation for each process by supplying a  
signal from outside to the control means, and  
5 the comparison result memory means stores  
the comparison data from each process.

10. The process exhaust gas monitoring  
device as claimed in claim 2, further comprising:  
10 nitrogen gas supply means for introducing  
nitrogen gas used in a zero calibration operation  
for the Fourier-transform infrared spectroscope to a  
gas introduction unit of the Fourier-transform  
infrared spectroscope; and  
15 zero-calibration control means for  
controlling the nitrogen gas supply means so that a  
zero calibration operation is performed at  
predetermined regular intervals.

20 11. The process exhaust gas monitoring  
device as claimed in claim 1 or 2, further  
comprising flow rate adjustment means for adjusting  
a flow rate of a gas flowing from the gas sampling  
means to the gas analysis means, the flow rate  
25 adjustment means being interposed between the gas  
sampling means and the gas analysis means

12. The process exhaust gas monitoring  
device as claimed in claim 11, further comprising  
30 alarm means for giving an alarm when the flow rate  
of the gas flowing from the gas sampling means to  
the gas analysis means is outside a predetermined  
range.

35 13. The process exhaust gas monitoring  
device as claimed in claim 1 or 2, wherein  
a process device that generates the

process exhaust gas comprises a vacuum pump for exhausting the process exhaust gas, and

the process exhaust gas monitoring device further comprises constant flow rate control means  
5 for supplying a constant flow rate of inert gas to the vacuum pump.

14. A semiconductor manufacturing device comprising:

10 a process chamber for processing a process object under predetermined process conditions, a process exhaust gas being generated during the process;

15 exhaust means for exhausting the process exhaust gas generated in the process chamber; and

a process exhaust gas monitoring device as claimed in any of claims 1 through 13, which device is connected to the exhaust means and monitors the process exhaust gas sampled through the exhaust  
20 means.

15. A method of monitoring process exhaust gas containing a plurality of gas components generated from a process carried out for a process

25 object under predetermined process conditions,

said method comprising the steps of:

sampling the process exhaust gas;

analyzing the components of the sampled process exhaust gas;

30 comparing the gas analysis result with a reference analysis result of an analysis of process exhaust gas generated as a result of a process carried out under reference process conditions; and

generating and outputting a signal  
35 indicating a process error when it is determined that the amount of at least one gas component of the process exhaust gas has changed to an amount that is

outside a predetermined range set around a reference value obtained from the reference analysis result.

16. The method as claimed in claim 15,  
5 wherein the step of analyzing the components of the process exhaust gas is carried out by a Fourier-transform infrared spectroscope.

17. The method as claimed in claim 15 or  
10 16, further comprising the step of giving an alarm in accordance with the signal indicating a process error.

18. The method as claimed in claim 15 or  
15 16, further comprising the step of automatically adjusting process conditions in accordance with the signal indicating a process error.

19. A semiconductor manufacturing device  
20 control system comprising:

a semiconductor manufacturing device that exhausts exhaust gas during an operation;

a monitoring device for sending analysis  
data obtained from an analysis made by a Fourier-  
25 transform infrared spectroscope on the components of the exhaust gas from the semiconductor manufacturing device, the analysis data being sent to a data communication network; and

data accumulation control means that  
30 receives the analysis data from the data communication network, determines from the analysis data whether an error exists in process conditions of the semiconductor manufacturing device, transmits a signal indicating an error with a presumed cause  
35 of the error to the monitoring device via the data communication network, and accumulates and registers the analysis data in a database.

20. The semiconductor manufacturing device control system as claimed in claimed 19, wherein

5 the data accumulation control means transmits the signal indicating an error and accessory information related to the error to the monitoring device, and

10 the monitoring device displays the error in the process conditions and the cause of the error on a display screen in accordance with the signal indicating the error, and also displays information related to the error on the display screen in accordance with the accessory information.

15 21. A method of controlling a semiconductor manufacturing device, comprising the steps of:

20 sending analysis data obtained from an analysis made by a Fourier-transform infrared spectroscope on components of exhaust gas exhausted from the semiconductor manufacturing device, the analysis data being sent to a data communication network;

25 determining from the analysis data sent from the data communication network whether an error exists in process conditions for the semiconductor manufacturing device;

30 transmitting a signal indicating an error and an presumed cause of the error in the process conditions to the semiconductor manufacturing device via the data communication network; and

accumulating and registering the analysis data in a database.

35 22. The method as claimed in claim 21, wherein

the signal indicating an error is provided

with accessory information related to the error and then transmitted to the data communication network,

the error in the process conditions and the cause of the error are reported to an operation manager in accordance with the signal indicating the error, and

information related to the error is also reported to the operation manager in accordance with the accessory information.

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23. A method of controlling a semiconductor manufacturing device, comprising the steps of:

15 sending analysis data obtained from an analysis made by a Fourier-transform infrared spectroscope on components of exhaust gas exhausted from the semiconductor manufacturing device in operation, the analysis data being sent instantly to an analysis center;

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constructing a database by accumulating the analysis data from a plurality of semiconductor manufacturing devices in the analysis center; and

controlling each of the plurality of semiconductor manufacturing devices in accordance with the database.

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**CLAIMS ADDED UNDER ARTICLE 19(1) TO PCT APPLICATION**

**ON MARCH 23, 2001**

AMENDMENT UNDER ARTICLE 19(1)

24. (ADDED) The process exhaust gas  
monitoring device as claimed in claim 2, wherein  
5 said Fourier-transform infrared spectroscope is  
connected to an exit of a vacuum pump that exhausts  
the process exhaust gas.

25. (ADDED) The method for monitoring  
10 exhaust process gas as claimed in claim 16, wherein  
the process exhaust gas is sampled at an exit of a  
vacuum pump that exhaust the process exhaust gas so  
as to be supplied to said Fourier-transform infrared  
spectroscope.

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